This Page Is Inserted by IFW Operations
and is not a part of the Official Record

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

As rescanning documents *will not* correct images, please do not report the images to the Image Problems Mailbox.

Related Pending Application
Related Case Serial No: 09/926,224
Related Case Filing Date: 09-26-01

Claims

1. A method for matching the phase between the pixel clock of a graphics card and the sampling clock of a flat-panel display with an analog interface in a system comprising flat-panel display, graphics card and computer, characterized in that the rising edge of a video pulse of a sufficiently bright image spot in the first image column close to the back-porch region is determined, in that the falling edge of a video pulse of a sufficiently bright image spot in the last image column close to the front-porch region is determined and in that the phase is adjusted such that the sampling instant is situated approximately at the midpoint between the rising and falling edges of a video pulse.

2. A method for matching the phase between the pixel clock of a graphics card and the sampling clock of a flat-panel display with an analog interface in a system comprising flat-panel display, graphics card and computer, characterized in that the rising edge of a video pulse of a sufficiently bright image spot in the first image column close to the back-porch region is determined, and in that the phase is adjusted such that the sampling instant is shifted by approximately half the width of an image spot toward the center of the pixel.

3. A method for matching the phase between the pixel clock of a graphics card and the sampling clock of a flat-panel display with an analog interface in a system comprising flat-panel display, graphics card and computer, characterized in that the falling edge of a video pulse of a sufficiently bright image spot in the last image column close to the front-porch region is determined, and in that the phase is adjusted such that the sampling instant is shifted by approximately half the width of an image spot toward the center of the pixel.

4. A method according to one of claims 1 to 3, characterized in that the brightness of a plurality of image spot of the first or last image column is measured, and the image spots with the greatest brightness in the first or last image column is chosen for determination of the rising or falling edge respectively of the video pulse.

5. A method according to one of claims 1 to 4, characterized in that the image spots (n x k) are first measured with n = 1, 2, ... N and k = constant, such as 10, and in that, if no adequately bright image spot was found, the image spots (n + m) x k are measured with m = 1, 2, ... N, until a sufficiently bright image spot is found.

6. A method according to one of claims 1 to 3, characterized in that, for determination of the amplitude value of the image spot, the phase is shifted until the measured amplitude values no longer change significantly, and in that the amplitude value then determined is further processed.

7. A method according to one of claims 1 to 3, characterized in that the phase used for determination of the amplitude value is advanced sufficiently that the measured amplitude values are smaller than a predetermined limit value, for example smaller than 50% of the amplitude value, in that the phase is delayed by half the width of a spot, and in that the amplitude value then measured is further processed.

8. A method according to one of claims 1 to 3, characterized in that, for determination of the rising edge, the phase is shifted sufficiently toward the back-porch region that the measured amplitude value is reduced to a predetermined percentage, for example 50%, of the previously determined

amplitude value, and in that this value of the phase is stored temporarily as the position of the rising edge.

9. A method according to one of claims 1 to 3, characterized in that, for determination of the falling edge, the phase is shifted sufficiently toward the front-porch region that the measured amplitude value is reduced to a predetermined percentage, for example 50%, of the previously determined amplitude value, and in that this value of the phase is stored temporarily as the position of the falling edge.

10. A method according to one of claims 1 to 3, characterized in that the phase or sampling instant is delayed relative to the midpoint between the rising and falling edges by a predetermined amount, for example 10% of the width of the image spot.

11. A device for matching the phase between the pixel clock of a graphics card and the sampling clock of a flat-panel display with an analog interface in a system comprising flat-panel display, graphics card and computer, characterized by a device which determines the rising edge of a video pulse of a sufficiently bright image spot in the first image column close to the back-porch region, by a device which determines the falling edge of a video pulse of a sufficiently bright image spot in the last image column close to the front-porch region and by an adjusting device with which the phase is adjusted such that the sampling instant is situated approximately at the midpoint between the rising and falling edges of a video pulse.

12. A device for matching the phase between the pixel clock of a graphics card and the sampling clock of a flat-panel display with an analog interface in a system comprising flat-panel display, graphics card and computer, characterized by a device which

determines the rising edge of a video pulse of a sufficiently bright image spot in the first image column close to the back-porch region, and by an adjusting device with which the phase is adjusted such that the sampling instant is shifted by approximately half the width of an image spot toward the center of the pixel.

13. A method for matching the phase between the pixel clock of a graphics card and the sampling clock of a flat-panel display with an analog interface in a system comprising flat-panel display, graphics card and computer, characterized by a device which determines the falling edge of a video pulse at a sufficiently bright image spot in the last image column close to the front-porch region, and by an adjusting device with which the phase is adjusted such that the sampling instant is shifted by approximately half the width of an image spot toward the center of the pixel.

14. A device according to one of claims 11 to 13, characterized by a device for shifting the phase for determination of the instant of sampling of the image spot until the measured amplitude values no longer differ significantly, whereupon the sampling value then determined is further processed.

15. A device according to one of claims 11 to 13, characterized by a device which advances the phase used for determination of the sampling value sufficiently that the measured amplitude values are smaller than a predetermined limit value, such as smaller than 50% of the sampling value, and by a device which then retards the phase by half the width of an image spot, whereupon the sampling value measured then is further processed.

16. A device according to one of claims 11 to 13,

characterized by a device which shifts the phase for determination of the rising edge sufficiently far toward the back-porch region that the measured amplitude value decreases to a predetermined percentage, such as 50% of the previously determined amplitude value, whereupon this value of the phase is stored temporarily as the position of the rising edge.

17. A device according to one of claims 11 to 13, characterized by a device which shifts the phase for determination of the falling edge sufficiently far toward the front-porch region that the measured amplitude value decreases to a predetermined percentage, such as 50% of the previously determined amplitude value, whereupon this value of the phase is stored temporarily as the position of the falling edge.

Abstract

Method and device for matching the phase in flat-panel displays

The invention relates to a method and a device for matching the phase between the pixel clock of a graphics card and the sampling clock of a flat-panel display with an analog interface in a system comprising flat-panel display, graphics card and computer. Herein the rising edge of a video pulse of a sufficiently bright image spot in the first image column close to the back-porch region is determined. The falling edge of a video pulse at a sufficiently bright image spot in the last image column close to the front-porch region is determined, and the phase is adjusted such that the sampling instant is situated approximately at the midpoint between the rising and falling edges of a video pulse.

Fig. 4

FIG 1

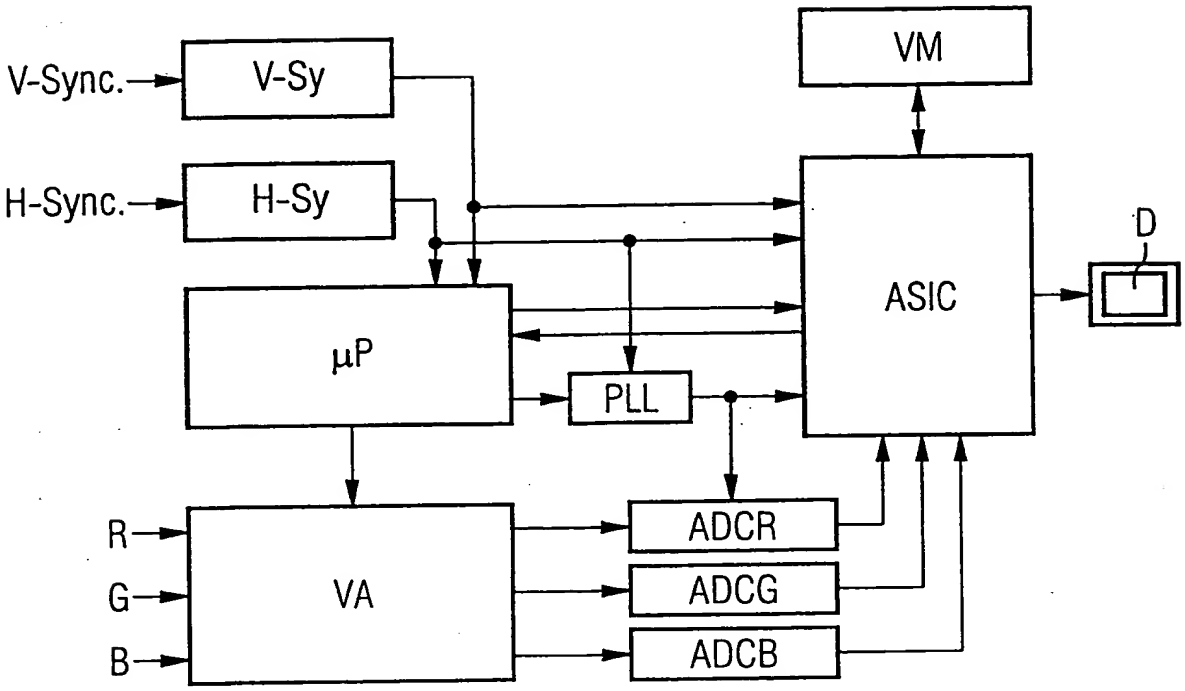
V-Sync.
V-Sy
H-Sync.
H-Sy
VM
ASIC
D
µP
PLL
R
G
B
VA
ADCR
ADCG
ADCB

FIG 2

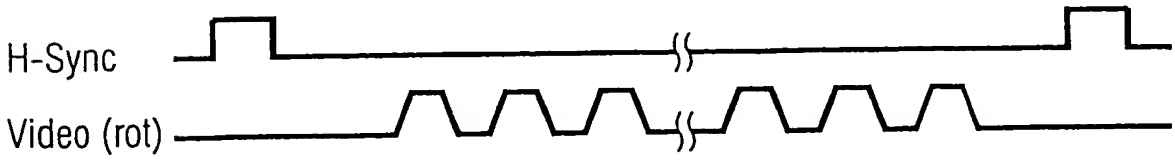
H-Sync
Video (rot)

FIG 3A

Schnelles Videosignal
mit Überschwinger

FIG 3B

Träges Videosignal

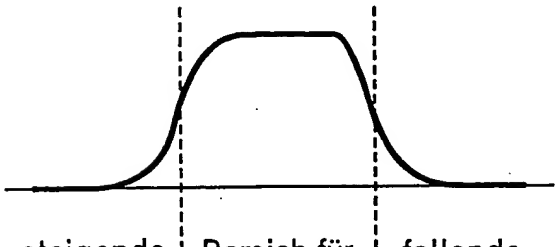

FIG 4

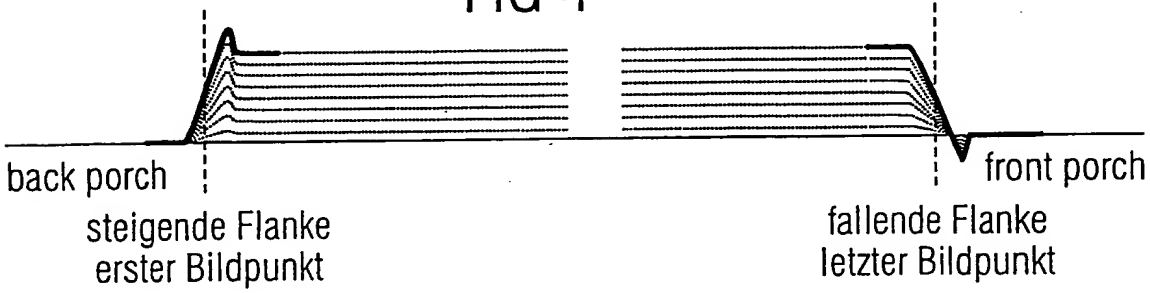

FIG 5A

Ideales Videosignal

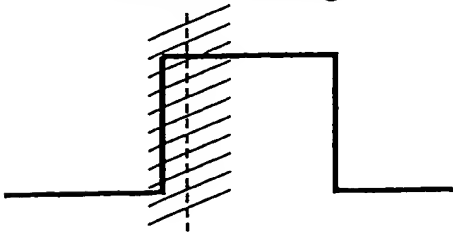

FIG 5B

Ideales Videosignal